

Remarks

Claims 1-11 are pending in the application. Claims 1-11 are rejected. Claims 1, 2, 4 and 6-11 are amended. Claim 12 is new. No new subject matter is added.

Claimed is a method for estimating a channel impulse response in an ultra wide bandwidth (UWB) system. A training sequence is generated and modulated at a chip rate to produce a modulated training sequence. The modulated training sequence is made up of ultra wide bandwith radio pulses. A plurality of repetitions of the modulated training sequence is used to generate a training signal, which is transmitted and received, via the channel. The received training signal is sampled in parallel with a set of correlators to obtain a plurality of samples. Each correlator samples the received training signal at a sampling rate substantially slower than the chip rate and samples the signal at a different delay for each repetition of the training sequence in the received training signal. The plurality of samples spans a time interval corresponding to an impulse response of the channel at a resolution substantially equal to the chip rate. The impulse response of the channel over the time interval corresponding to the impulse response of the channel is estimated from the plurality of samples.

Claims 1-6, 9 and 10 are rejected under 35 U.S.C. 103(a) as being unpatentable over Richards et al., U.S. Patent Application Publication No. 2003/0232612 (Richards) in view of Ylitalo et al., U.S. Patent No. 6,215,814

(Ylitalo), Tewfik et al., U.S. Patent Application Publication No. 2004/0141559 (Tewfik) and Nilsson, U.S. Patent No. 6,835,689 (Nilsson).

None of the references cited by the Examiner teach the claimed generating of a training signal comprised of a plurality of repetitions of a modulated training sequence. The generation of a training signal in this manner is important because it allows low costs components to be used in the receiver, in contrast with the prior art, see Specification, paragraphs [012]-[014], [030].

Richards is merely concerned with received waveform edge detection to allow determination of data signal modulation format. In Figure 8 and paragraphs [0156]-[0159], Richards describes conventional UWB timing determinations, which include sampling of the received signal at every possible time offset, *i.e.*, *at the chip rate*. As stated in the Applicants' Specification at paragraph [013], these systems can be prohibitively expensive, and the claimed invention overcomes this problem by the claimed generating of a training signal comprised of a plurality of repetitions of a modulated training sequence and the claimed sampling of the received training signal at a different delay for each repetition of the training sequence in the received training signal by each correlator, so that the set of correlators may sample the received training signal at a sampling rate *substantially slower than the chip rate* but still obtaining a plurality of samples spanning a time interval corresponding to an impulse response of the channel at a resolution substantially equal to the chip rate. Richards fails

to describe a training signal comprised of a plurality of repetitions of a modulated training sequence.

Furthermore, at paragraph [0193], Richards states that a particular embodiment has “correlators [that] may be designed for lower frequency operation than the first stage correlator.” However, contrary to the Examiner’s argument, this is *not* the same as the claimed sampling of the received training signal in parallel with a set of correlators, each correlator sampling at a sampling rate substantially slower than the chip rate and at a different delay for each repetition of the modulated training sequence in the received training signal. It is clear from the description in Richards that this embodiment assumes correct timing in “the first stage correlator” 1706, which is achieved *conventionally*, see Figure 17 and paragraphs [0189]-[0193]. To clarify, Richards samples a received signal at the chip rate and further processes the signal at a lower frequency, while the claimed invention samples a received signal at a sampling rate substantially slower than the chip rate and at a different delay for each repetition of the modulated training sequence in the received training signal. As stated above, Richards fails to teach a training signal comprised of a plurality of repetitions of a modulated training sequence. Therefore, while Richards may process a signal at a lower frequency than the chip rate, he does not teach sampling at a different delay for each repetition of the modulated training sequence in the received training signal.

Ylitalo, Tewfik and Nilsson all fail to cure the numerous defects of Richards. Ylitalo discloses only “pilot bits” with no further explanation as to

their nature. Surely, this is insufficient to teach the claimed generating of a training signal comprised of a plurality of repetitions of a modulated training sequence. Likewise, Tewfik and Nilsson contain no description of training signals comprised of a plurality of repetitions of a modulated training sequence.

Additionally, as the combination of Richards, Ylitalo, Tewfik and Nilsson does not teach the claimed generating of a training signal comprised of a plurality of repetitions of a modulated training sequence, it is impossible for the combination of the references to teach the claimed sampling, by each correlator, at a sampling rate substantially slower than the chip rate and at a different delay for each repetition of the modulated training sequence in the received training signal.

As Richards, Ylitalo, Tewfik and Nilsson do not teach the claimed generating of a training signal comprised of a plurality of repetitions of a modulated training sequence, the combination of the references cannot make the claimed invention obvious.

Claims 2-6, 9 and 10 depend on claim 1 and the above arguments hold for these rejections as well.

Claims 7, 8 and 11 are rejected under 35 U.S.C. 103(a) as being unpatentable over Richards in view of Ylitalo, Tewfik and Nilsson, and further in view of Jung et al., U.S. Patent Application Publication No. 2004/0097204 (Jung).

Jung similarly fails to teach the claimed generating of a training signal comprised of a plurality of repetitions of a modulated training sequence and the claimed sampling, by each correlator, at a sampling rate substantially slower than the chip rate and at a different delay for each repetition of the modulated training sequence in the received training signal. The combination of Richards, Ylitalo, Tewfik, Nilsson and Jung cannot make the claimed invention obvious.

It is believed that this application is now in condition for allowance. A notice to this effect is respectfully requested. Should further questions arise concerning this application, the Examiner is invited to call Applicants' attorney at the number listed below. Please charge any shortage in fees due in connection with the filing of this paper to Deposit Account 50-0749.

Respectfully submitted,
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